Governor's STEM Advisory Council
Regional STEM Network Hub
Application

April 6, 2012

North Central Region

Iowa State University

Name of proposed requesting entity (or entries as partners):
Iowa State University

Name and title of primary contact:
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Region:
North Central

Proposed Location:
The Iowa State University North Central Regional STEM Network Hub (hereinafter called the NC STEM Hub) will be housed in the Extension 4-H Youth Building on the north side of the ISU Campus. This building serves as the front door for ISU Extension and Outreach (ISUEO) on the ISU Campus and offers very compatible functional purposes with the present building occupants for the NC STEM Hub. Currently, this building is the home for 65 Extension professionals and support staff, including the State 4-H Youth Development Office, Extension Communication and External Relations, and the Iowa 4-H Foundation. These professionals already have significant relationships with ISU Colleges (i.e., Agriculture and Life Sciences, Business, Design, Engineering, Human Sciences, Liberal Arts and Sciences, and Veterinary Medicine) as well as faculty across diverse academic disciplines. This location provides easy public access with both temporary and all day parking nearby, an important advantage for face-to-face meetings and conferences. The Building is designed with large (50 person), medium (16 person) and small (6 person) conference rooms for multi-media presentations, Internet connectivity, and teleconferencing capabilities. The ISU Extension 4-H Youth Building is the perfect location, with all the necessary amenities needed for an effective, efficient, STEM Network Hub.

Identify Your Mission:
Iowa State University (ISU) is an international, prestigious university known for its strengths in science and technology, and has a successful history of discovery and innovation. The mission of ISU's NC STEM Hub is consistent with ISU's strategic plan for 2010-2015titled, "Meeting the challenges of the 21st century." Therefore, the Regional STEM Hub will further the university's mission and goals. As the land-grant institution in the state of Iowa, ISU is committed to putting science, technology, and human creativity to work.

ISU's Extension and Outreach (ISUEO) mission is one of the nation's largest providers of scientific-based information and education. Extension's network serves communities in all 99 Iowa counties and across the U.S. Extension offers practical, how-to education based on powerful university research. As the lead

entity of the NC STEM Hub, ISU is committed to capitalizing its strength and engaging with partners to realize the goals and of the NC STEM Hub as well as the state of Iowa.

As a major partner in the NC STEM Hub, the Center for Excellence in Science, Mathematics, and Engineering Education (CESMEE) will contribute and facilitate research, professional development, and advocacy for STEM education.

NC STEM Hub Mission

To form partnerships that create, share, and apply knowledge to grow STEM education pathways that inspire 21st century learners and contribute to Iowa's economic development.

The goals of the NC STEM Hub are grounded in the Iowa STEM Education Roadmap.

Goals

Goal 1: Create an environment within the NC region and the state of Iowa to advance STEM education in order to increase students' career aspirations, positive STEM attitudes, and 21st Century Skills to prepare all students for success in school, work and life by engaging Iowa State University (ISU) faculty, staff, and regional partners and leveraging the ISU Extension and Outreach (ISUEO) statewide network.

School (K-12)
• Improved student achievement as measured by grades, course completions, standardized test scores and participation in STEM majors, notably a particular gain made by students of underrepresented groups.
• Upward trends in placement test scores and career assessments such as ACT® and COMPASS.
• Increased student interest in STEM as they progress through K-12 and postsecondary coursework.
• Decrease in the number students underprepared for STEM study at the secondary and higher education levels.
• Higher proportional engagement of females and students of racial and ethnic minorities in STEM programs and majors in higher education, including teaching (e.g., Project Lead The Way, Science Bound).
• Expand college credit options for high-ability high school students by incentivizing partnerships between/among colleges/universities, businesses, non-profits, high schools, etc.

School (Postsecondary)
• Increased levels of cooperation and collaboration among the universities, community colleges, and private colleges, K-12 schools, AEAs, museums, clubs, businesses and other groups.
• Provide support for all regions in fulfillment of ISU's Land Grant Extension and Outreach mission.
• Increased student interest in STEM as they progress through K-12 and postsecondary coursework.
• Higher proportional engagement of females and students of racial and ethnic minorities in STEM programs and majors in higher education, including teaching.
• Decrease in the number of students underprepared for STEM study at the secondary and higher education levels.
• Leverage STEM transfer and articulation policies and programs between Iowa's community colleges and ISU.

Work
• Leverage and promote resources and initiatives which integrate and assess Iowa Core Curriculum 21st Century Skills (Employability, Technology Literacy, Health Literacy, and Financial Literacy) http://educateiowa.gov/index.php?option=com_content&view=article&id=2332&Itemid=4344
• Develop and leverage data systems, which track students in STEM majors and STEM careers.
• Increased supply of STEM-ready workforce within Iowa.
• Continue to build and maintain a network of career models and mentors to increase career aspirations.

Life
• Leverage and promote resources and initiatives which integrate and assess Iowa Core Curriculum 21st Century Skills (Employability, Technology Literacy, Health Literacy, and Financial Literacy) http://educateiowa.gov/index.php?option=com_content&view=article&id=2332&Itemid=4344
• Equip Iowa citizens to be lifelong and adaptable learners through the functions of education, formal/informal programs (e.g., campus and community based programs) and professional development through Iowa State University and ISUEO.

Goal 2. Provide professional development in STEM education to teachers, (K-12, community college, and 4 year), administrators, school board members and community leaders in order to effectively implement content and process skills and teaching strategies detailed in the Iowa Core.

• Provide professional development focused on creating classroom environments, pedagogy, and programs that support success in STEM courses by underrepresented populations.
• Leverage model STEM classrooms, master teachers, and programs in order to demonstrate effective teaching and learning approaches detailed in the Iowa Core.
• Increase the amount of professional development co-delivered by the Iowa Department of Education, the AEAs, the colleges and universities and/or qualified private sector entities, which adhere to the Iowa Professional Development Model.
• Use the ISU Extension and Outreach network and staff to engage STEM educators and faculty at other public and private institutions engaged in teacher preparation.
• Coordinate and employ the expertise of the ISU School of Education faculty, ISU STEM discipline faculty, ISUEO and business/industry, etc.
• Host a broad range of events that aim to bring ISU STEM faculty into the hub (e.g., social, community building, celebratory, shared workshops between community colleges and ISU, shared workshops between high schools and ISU).
• Scale-up ISU's STEM education reforms and programs to K-12 schools and postsecondary sectors (e.g., Howard Hughes Medical Institute [HHMI], cases using ThinkSpace, math education center, Engineering 160 projects, Student Innovation Center, active learning pedagogies, etc.
• Host content-based professional development for high school and community college faculty.

Goal 3. Increase in the number, quality and diversity of new recruits to mathematics, science and technology teaching at Iowa State University.

• Increased numbers of new teaching graduates using exemplary curriculum and who integrate the most up-to-date innovations including technology, engineering education, interdisciplinary, etc.
• Leverage the Iowa Teach Model to increase undergraduates in STEM disciplines who enter STEM teaching fields.
• Increase the number, quality, and diversity of students who pursue an ISU STEM graduate degree and

aspire to teach in Iowa's postsecondary institutions such as (e.g., community colleges, universities, etc.).
• Work with ISU's School of Education in the College of the Human Sciences and policymakers to develop systems and programs that enhance alternative pathways to teacher certification for working STEM professionals to aid their transition to the classroom.

Goal 4: Strengthen existing partnerships and cultivate new partnerships with business and industry, government, community organizations, and educational entities to leverage expertise and resources to support the mission and the vision of the NC STEM Hub.

• Convene and engage the Regional Advisory Council and regional resources in support of the mission and goals of the NC STEM Hub.
• Foster community dialogues to increase STEM awareness, credibility and understanding across the North Central region.
• Increase the quality and quantity of STEM-related after school and summer enrichment programs and STEM active learning experiences (e.g., workplace learning, research experiences for teachers and students, and service learning) in the NC region

Goal 5: Utilize the regional and statewide ISU Extension & Outreach network to support the goals of the NC STEM Hub as a land grant university serving the entire state of Iowa.

• Make connections to engage ISU Extension and Outreach program staff, faculty, county educators/specialists, county extension councils, and all STEM Regional Hubs in support of STEM education and Hub effectiveness
• Use existing networks within Extension and Outreach to facilitate the formation of STEM education collaborations.
• Work with policymakers and formal education systems to develop alternative opportunities to allow youth to receive credit for non-formal educational experiences.

Goal 6. Create a NC STEM Hub clearinghouse to collect and disseminate STEM education resources utilizing web-based, professional networking, and social media technologies.

• Increase engagement between and among regional/state partners with the use of technology.
• Disseminate effective practice and promising programs, current STEM pathway research, and regional/state STEM success indicators/data to regional and state partners.
• Utilize the Iowa 4-H CYSTEM tool to support STEM pre-collegiate outreach by using GIS mapping to facilitate connecting with STEM programs, mentors, and careers. http://ags.gis.iastate.edu/cystem
• Provide support and professional development for programs and classrooms to utilize social media tools to engage and inspire students in STEM education. (i.e., ISU's Center for Technology in Learning and Teaching [CTLT])

Goal 7. Develop and implement a rigorous evaluation and assessment strategy that will inform the NC STEM Hub goals and track progress to stakeholders and the public.

• Identify and operationalize STEM education outcomes/success indicator data.
• Engage Regional Advisory Council in logic model planning processes.
• Invest time and resources into outcomes and success indicator work for the NC STEM Hub region and the state of Iowa.

Identify Support:
Iowa State University and Iowa State University Extension and Outreach (ISUEO) agree to support 50% of the NC STEM Hub expenses. Because this is such a critical priority for ISU, ISU agrees to provide a half-time support staff position, all furniture, computers, network, email access and other start-up costs. Access to ISU's Transportation Services, another distinct advantage, will address all transportation needs. Travel expenses for the NC STEM Advocate and Hub staff are proposed to be shared with the STEM Council funding. As strategic plans are created, ISU facilities will be free to activities held on campus. Additional meeting/conference expenses will be budgeted for within the Hub operations or charged to participants.

The Office of Research and Economic Development at ISU will play a critical role in support of the NC STEM Hub goals and objectives. Additionally, the Deans from the seven academic colleges (Agriculture and Life Sciences, Business, Design, Engineering, Human Sciences, Liberal Arts and Sciences, and Veterinary Medicine) fully support the mission, goals and objectives of the NC STEM Hub. This proposal reflects input from representatives from each of the colleges. The NC STEM Hub will work with ISU's Division of Student Affairs, in particular, the Office of Admissions to target diverse students to pursue STEM degrees.

The College of Human Sciences fully supports the formation of a NC STEM Hub and looks forward to not only how we can contribute to the Hub activities, but also to the vibrancy of STEM activities brought to ISU through this connection. Coincidentally, the formation of our School of Education within the College of Human Sciences will be occurring at the same time. The School has a noted emphasis in preparing educators in STEM Education. The vision of the new School of Education will be a premier leader in education with a special emphasis in STEM education and leadership. The School will advance research and scholarship in the areas of teaching, learning, and leadership for PK-20 and prepare professionals for instructional environments of schools, community colleges, and universities globally. The mission of the School of Education is to create, share, and apply knowledge to improve education in Iowa and the world. The School will prepare excellent research informed educators, researchers, administrators, and others to serve the education sector. The elementary education students at Iowa State take a unique series of courses in mathematics, designed especially for educators by ISU mathematics and education faculty. Data show this sequence of customized courses increases ISU's pre-service teachers' mathematical knowledge for teaching by one standard deviation. And, research demonstrates the increased knowledge of our students translates into a gain equivalent to three more months of mathematics instruction per year for their students. Also, Iowa State's instructional technology sequence prepares future teachers to embrace research-proven strategies that improve student learning. It follows that eight of 12 voting members of the Iowa Technology Education Connection (ITEC) board are ISU graduates, leading the use of educational technology for all Iowa K-12 schools.

In addition to the NC STEM Hub staff, ISU and ISUEO will offer faculty and specialist partnerships where similar program goals exist. Such is the case within the arena of pre-collegiate programming, a critical priority of the Extension 4-H Youth Program and ISU Colleges. Because STEM educational programs are a mission mandate of our Extension 4-H Youth Program, the Extension staff in the north central region and the entire state, will be available to support the strategic goals of this Hub and provide an important capacity advantage. Salaries from these staff could be used as match to provide a significant advantage to secure potential grants as well as their creative and innovative programming expertise. In addition, as a Land Grant University, ISU has partnerships with the other 106 such Universities across the country. These connections, plus regional and national Extension 4-H Youth science programming goals, provide

a source of significant expertise second to none to accomplish the North Central Region and statewide STEM goals.

Participating Organizations:

Area Education Agencies (AEAs):
• Prairie Lakes, Heartland, 267

Community Colleges:
• Partners: Des Moines Area Community College (Boone Campus), Ellsworth Community College, Iowa Central Community College, Marshalltown Community College, North Iowa Area Community College.
• ISU Admissions Partnership Program (APP), Engineering Admissions Program (E-APP)
• Established articulation agreements (program and course-level) into STEM disciplines (e.g., Agriculture, Engineering, etc.)
• Cross-enrollment for students enrolled at DMACC and ISU
• ISU's Community College Leadership Program educates and trains current and future leaders, STEM faculty, staff, etc.

Private Colleges:
• Buena Vista (satellite campus)
• Waldorf College

Work Force Development; Economic Development Commissions; Chambers of Commerce; Community Service Organizations; Libraries; Local and County Government, Hospitals and Medical Centers:
• ISUEO has a community presence in every county in the state.
• Community and industry programs within Extension and Outreach have collaborative relationships in place with workforce development, economic development commissions, chambers of commerce, community service organizations, etc.

Informal Education:
• Boys and Girls Clubs, Scouts

Industry
• ISU has extensive relationships with industry across the region, state and world through internships, professional development, mentoring, externships. Industries support ISU's STEM functions through the provision of resources and personnel (e.g. FIRST Lego League, IT Adventures, State Science and Technology Fair of Iowa). Iowa State's alumni are an integral asset in connecting ISU to industry.

• ISU also supports emerging industries and startup companies through the Small Business Development Center and the Center for Industrial Research and Services (CIRAS).

• Career and Placement Services at ISU work extensively with business, industry, and education in terms of student internships and placement as well as tracking workplace demographic trends.

Key representatives that will comprise the NC STEM Hub Regional Advisory Council (RAC) will be identified during the early process. The goal is to convene the RAC quarterly in order to engage regional partnership development activities. This proposal provides a framework for regional hub activity. Regional partners will be engaged around this framework to define their interests and role in the STEM education system and to develop logic model planning documents in order to identify targeted

activities, outcomes, and outputs. Collaborative implementation is the overarching goal of the partnership.

Funding Assistance:
ISU and ISUEO have the important advantage of having two private fund raising entities to support resource development for the STEM Hub – the ISU Foundation and the Iowa 4-H Foundation. Both organizations have STEM youth education as a fund raising priority with a proven track record in this arena. The ISU Foundation has had great success in securing significant donations and grants. The existing relationships that these foundations have with both private and university partners will facilitate the identification of an appropriate and effective support system. Staff expertise through the Grants and Contracts Office will be available to meet the important challenge.

Becoming the NC STEM Hub is fully integrated within the mission of ISU and ISUEO. Because of this compatibility the Director of 4-H Youth Programs will share supervision of the STEM Advocate with the STEM Regional Council and the Director of the Governor's STEM Advisory Council.

Additional Information:
Iowa State University is an international, prestigious university with a friendly welcoming personality. More than 29,000 (Fall 2011 headcount – 29,887) students choose from 100 majors, study with world-class scholars and hone their leadership skills in more than 800 student organizations. Iowa State offers a great environment where students can enjoy reaching their potential and discovering their passions. It is a culturally diverse student body with students from all 50 states and more than 110 countries.

Iowa State University of Science and Technology is uniquely qualified as a STEM Hub and as a statewide partner for all hubs because of the University's Land Grant mission as well as unique partnerships on campus that bring special subject-matter expertise to the state.

As a Land Grant University, ISU Extension and Outreach's mission is to deliver research from the university to the state citizenry and ISU Extension and Outreach (E&O) has an existing network in place for delivering STEM programming to Iowa. E&O has five educational areas. These areas are 4-H Youth Development, Agriculture and Natural Resources, Center for Industrial Research and Service, Community and Economic Development, and Extension to Families. All five areas have STEM components, statewide clientele and stakeholders, and existing infrastructure that can be leveraged in support of the NC STEM Hub. These areas of focus include faculty and staff with expertise in STEM that have a presence both on campus and embedded within communities across the state. E&O serves in a dual role as: 1) a conduit that delivers research based information and learning from campus; and 2) a link for communication from the state back to campus. E&O is also developing partnerships with other universities to support their mission with Extension. Iowa State University Extension and Outreach can anticipate trends, build relationships, and catalyze opportunities because it is part of the ongoing life of Iowa's communities, committed to healthy people, healthy environments, and healthy economies.

Subject Matter Expertise:
ISU is uniquely qualified to serve as a regional convener of the NC STEM Hub and partner for all regional hubs. The faculty and staff provide world-renowned STEM education and research, an E&O network, and a plethora of STEM outreach programs that serves the entire state of Iowa, which does not exist in any other institution in Iowa.

ISU's Center for Excellence in Science, Mathematics, and Engineering Education (CESMEE) serves as a

research and development center focusing on conducting innovative research to create change in STEM education in K12, community colleges, and universities. The research and development work encompasses content in the STEM disciplines, instructional techniques, assessment practices, and educational or professional development experiences. Currently, CESMEE coordinates two campus-wide Iowa Mathematics and Science Education Partnership (IMSEP) projects. CESMEE also serves as a facilitator to connect researchers, industry, and educators in work relating to STEM serving the state.

The newly formed ISU School of Education prepares K-16 STEM teachers and provides graduate programming for educational leaders in Iowa's K-12, Community College, and 4 year systems. Recruiting and preparing world-class teachers and leaders is critical to the work of STEM education in Iowa.

The Center for Technology in Learning and Teaching (CTLT), which is housed in the new School of Education, is a community comprised of a collaborative group of faculty, staff, graduate, and undergraduate students who have created a learning environment that continually demonstrates powerful applications of technology that improve student learning. The CTLT faculty are continuously developing online learning experiences. These experiences range from utilizing social networking in the classroom to a complete Master of Education with specialization in Curriculum and Instructional Technology degree program at a distance. This online Master of Education program provides a flexible learning environment that is ideal for full-time teachers and other professionals looking to further their education.

The Research Institute for Studies in Education (RISE) has a long and successful history of serving research and evaluation needs. RISE and its team of experts are versed in the areas of PK-12 education, postsecondary education, community outreach and policy, and institutional research. Other areas of RISE's expertise include higher education administration and policy, STEM education, statistics, qualitative inquiry, teacher education and program and project evaluation. RISE works with clients in the fields of education, health and wellness, training and development, and business and industry. These projects have been local, statewide, regional, national, and international.

All colleges at ISU (Agriculture and Life Sciences, Business, Design, Engineering, Human Sciences, Liberal Arts and Sciences, Veterinary Medicine) have program and outreach that support STEM in Iowa. Many individual faculty and staff have developed outreach programs that reach across Iowa with special emphases in chemistry, biology, engineering, mathematics, entrepreneurship relating to STEM, and more. (See Table 1 at http://cesmee.iastate.edu/hub.php for a partial list).

The College of Agriculture and Life Sciences (CALS) also has a wide array of STEM support opportunities for the state of the Iowa and is rolling out the World Food Prize Iowa Youth Institute, where they will explore global issues in agriculture and be inspired to pursue educational and career paths in these areas in April of 2012. On July 17, 2011, Governor Branstad announced in his office, with bipartisan leadership of the Iowa State Legislature present, the creation of a new program to promote the study of STEM by allowing every high school in Iowa to select its own "Borlaug Scholar" to attend this all-day Iowa Youth Institute, to be held at Iowa State University on April 30, 2012. CALS also provides STEM programming and outreach for agriculture and biosystems engineering, agronomy, animal science, economics, entomology, food science, human nutrition, horticulture, natural resource ecology and management, plant pathology, and sociology.

ISU faculty and staff are conducting cutting-edge research that is adding to the knowledge base, economic growth, and educational outreach for Iowans. The ISU Research Experience for

Undergraduates and Research Experience for Teachers connect undergraduates and teachers with researchers in their labs. Teachers can spend their summer at ISU and practice in the fields of science and engineering with world-renowned researchers making them better teachers based upon these experiences that are open to all six regions. In addition to these, ISU has the Biotechnology Outreach Education Center, located in the Molecular Biology Building on the Iowa State University campus in Ames. The 2,300 square-foot center consists of two adjacent state-of-the-art laboratories with 40 lab stations and a preparation room. The center is fully stocked with the laboratory supplies needed for a number of biotechnology experiments. Equipment in the center supports procedures as simple as extracting DNA from bananas or as complex as polymerase chain reactions. Teacher professional development, outreach, and providing supplies for classrooms to do molecular biology are available to all of Iowa is another advantage for all of Iowa coming from ISU.

Ames Laboratory is a government-owned, contractor-operated research facility of the U.S. Department of Energy that is run by Iowa State University. Ames Laboratory seeks solutions to energy-related problems through the exploration of chemical, engineering, materials, mathematical and physical sciences. Established in the 1940s with the successful development of the most efficient process to produce high-quality uranium metal for atomic energy, the Lab now pursues a broad range of scientific priorities. Ames Laboratory shares a close working relationship with Iowa State University's Institute for Physical Research and Technology, or IPRT, a network of scientific research centers at Iowa State University, Ames, Iowa.

Science Bound is Iowa State University's premier pre-college program to increase the number of ethnically diverse Iowa students who pursue ASTEM (agricultural, scientific, technical, engineering and mathematics) degrees. The program reaches across three regions and draws students with potential from middle and high schools in Des Moines, Denison and Marshalltown, Iowa. Science Bound’s unique experience with reaching underserved audiences in STEM provides expertise in this critical area to the state.

The National Laboratory for Agriculture and the Environment (NLAE) is a trans-disciplinary laboratory focused on integrating the fundamental principles in soil, water, and air into animal, cropping and watershed systems that leads to improved environmental quality, sustainability, and enhanced agricultural system efficiency. The purpose of the NLAE is to develop innovative solutions to enhance the efficiency of agricultural systems and reduce their environmental impact. Its mission is to integrate soil, water, and air processes into animal, cropping, and watershed systems to enhance agriculture and protect the environment. This integrated mission requires a blending of diverse expertise across a number of scientific disciplines in order to generate these solutions. The 22 scientists within NLAE encompass a range of disciplines from biogeochemistry, soil physics, mathematics, chemistry, crop physiology, micrometeorology, animal nutrition, animal physiology, microbiology, watershed hydrology, agricultural engineering, agronomy, soil management, soil chemistry, and ecology. This diversity of scientific expertise within a single laboratory provides the foundation for the trans-disciplinary approach that allows this range of projects to be studied and the results to be generated.

ISU also has the 4-H and Youth Development’s STEM program that serves the entire state supporting both formal and informal education. This program is shared between ISU E&O and the Iowa Space Grant Consortium (ISGC). ISGC affiliates include A) Educational members: ISU, the University of Iowa, the University of Northern Iowa, and Drake University; B) Governmental members: Iowa Department of Natural Resources, U.S. Department of Energy’s Ames Lab, Iowa Department of Education, Iowa Department of Transportation, and the National Lab for Agriculture and the Environment; C) Industrial

members: Rockwell Collins, Aerial Services Inc., Aerodyne Laboratories, and Softronics; and D) Outreach Affiliates: Grout Museum District, Iowa Academy of Science, Iowa Aviation Promotion Group, National Mississippi River Museum and Aquarium, Putnam Museum and IMAX Theater, Science Center of Iowa, and Science Station.

The ISGC and 4-H and Youth Development both support Extension-Science, Engineering, and Technology (E-SET) in the mission to improve STEM learning for Iowa youth. E-SET provides teacher professional development and learning opportunities for Iowa youth that are held in partnership with the affiliates which form a statewide STEM network. E-SET has also developed a GIS-based STEM Network map for Iowa that is designed to allow mentors, STEM programs, and STEM career information to be identified by location. Youth, teachers, possible mentors, or STEM professionals can network using the searchable tool, which is located online at the following URL: http://ags.gis.iastate.edu/cystem

Additional Considerations:
Please see Table 1 for a partial list of outreach programs at ISU here http://cesmee.iastate.edu/hub.php
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